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10/775,566	02/10/2004	Fotios Papadimitrakopoulos	PFO-0002	1441
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EXAMINER				
DRODGE, JOSEPH W				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

usptopatentmail@cantorcolburn.com

Office Action Summary**Application No.**

10/775,566

Applicant(s)PAPADIMITRAKOPOULOS,
FOTIOS**Examiner**

Joseph W. Drodge

Art Unit

1797

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 March 2008.
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1-23 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____

GROUND OF REJECTION

*****Text added by this Office Action concerning Clarified and New Grounds of Rejection are in Bold Face*****

The indicated allowability of claims 1-23 is withdrawn in view of the newly discovered reference(s) to Sun et al PGPUBS Document US 2003/0001141 and corresponding Provisional Application and Non-Patent Literature of Zhao et al and Chen et al. Rejections based on the newly cited reference(s) follow. The 112, 1st paragraph rejection is also reinstated and an Obvious Double Patenting rejection based on U.S. Patent 7,131,537 in view of Sun et al is also advanced.

Claims 1-23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is now deemed unclear as to the meaning of "without adsorption to a template". There are at least two alternative meanings for the terminology "template" associated with nanotube growth and separation and associated with prior art in nanotube technology. The term 'template' can firstly be interpreted in the context of a structure having base original sites for selective precipitation, adsorption or absorption of nanotubes as is presented in the applied prior art of record Schleier-Smith et al patent 6,669,918 at column 5, lines 12-24. The term 'template' can secondly be interpreted in the context of a seeding in the growth of nanotube structures especially of nanotube fibers or fibrous structures as is presented in newly cited Smalley patent 6,683,783. The ordinarily skilled artisan would not know which of the at least two conflicting meanings in

nanotube technology was intended to be excluded by use of the negative limitation of terminology excluding “templates”. It is further noted that paragraph 17 of the instant Specification refers to nanotube fibers, suggesting at least the possibility of seeding type templates being used in the formation or growth of such nanotube fibers.

Claims 1-23 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Upon further review, the added limitation to claim 1 and other independent claims of means for inducing selective precipitation excluding adsorption to a template are considered to not be supported by the Specification as originally filed and constitute New Matter.

Any negative limitation or exclusionary proviso must have basis in the original disclosure.

If alternative elements are positively recited in the specification, they may be explicitly excluded in the claims. See *In re Johnson*, 558 F.2d 1008, 1019, 194 USPQ 187, 196 (CCPA 1977) ("[the] specification, having described the whole, necessarily described the part remaining."). See also *Ex parte Grasselli*, 231 USPQ 393 (Bd. App. 1983), *aff'd mem.*, 738 F.2d 453 (Fed. Cir. 1984). The mere absence of a positive recitation is not basis for an exclusion. Any claim containing a negative limitation which does not have basis in the original disclosure should be rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. Note that a lack of literal basis in the specification for a negative limitation may not be sufficient to establish a *prima facie* case for lack of descriptive support. *Ex parte Parks*, 30 USPQ2d 1234, 1236 (Bd. Pat. App. & Inter. 1993). **However, there must be basis in the Specification for adding a negative limitation. There must be express disclaimer or independent lexicography in the written description that would justify adding such negative limitation. *Omega Engineering Inc. v. Raytec Corp.*, 67 USPQ2d 1321, U.S. Court of Appeals Federal Circuit 2003.** See MPEP § 2163 - § 2163.07(b) for a discussion of the written description requirement of 35 U.S.C. 112, first paragraph, and MPEP 2173.05(i) for Discussion of "Negative Limitations", *per se*. **Nothing in the Specification excludes selective adsorption, absorption or precipitation by means comprising formation of a template to a greater or lesser degree.**

Additionally, there are at least two alternative meanings for the terminology "template" associated with nanotube growth and separation and associated with prior art in nanotube technology. The term 'template' can firstly be interpreted in the context of a structure having base original sites for selective precipitation, adsorption or absorption of nanotubes as is presented in the applied prior art of record Schleier-Smith et al patent 6,669,918 at column 5, lines 12-24. The term 'template' can secondly be interpreted in the context of a seeding in the growth of nanotube structures especially of nanotube fibers or fibrous structures as is evidenced by newly cited Smalley patent 6,683,783. The ordinarily skilled artisan would not know which of the at least two conflicting meanings in nanotube technology was intended to be excluded by use of the negative limitation of terminology excluding "templates". It is further noted that paragraph 17 of the instant Specification refers to nanotube fibers, suggesting at least the possibility of seeding type templates being used in the formation or growth of such nanotube fibers. In this sense, the Specification suggests rather than excludes templates in the context of seeding.

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 1-23 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-11 of U.S. Patent No. 7,131,537 in view of Sun et al PGPUBS Document US 2003/0001141, based on Provisional Application 60/286,340 filed on April 26, 2001. The instant claims differ from the claims of '537 in requiring that the nanotubes being separated are functionalized prior to contact with solvent instead of the functionalizing occurring as a part of the contacting with solvent. However, Sun et al at paragraph 21 state that mixtures of nanotubes to be separated may be either pristine (non-functionalized) or functionalized prior to contact with solvent. The instant claims also differ in requiring a means for inducing selective precipitation, to separate out types of nanotubes, instead of being separated by permeation and/or by magnetic separation as in the claims of '537. However, Sun et al at paragraphs 52 and 63 teach that chromatographic separation is a form of selective separation of types of nanotubes such as metallic versus semiconducting nanotubes from mixtures of nanotubes that are dispersed or suspended in a solvent. Such chromatographic separation is considered to be a form of selective precipitation in the sense that different populations of nanotubes in a solvent mixture passing through chromatographic columns or media selectively precipitate out of solution to adsorb or absorb, or 'precipitate' to surfaces of the chromatographic media.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(c) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an

international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-23 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Sun et al PGPUBS Document US 2003/0001141, based on provisional application 60/343,055 (effective filing date of 04/26/2001), if necessary in view of Lobovsky et al patent 6,682,677 and if necessary in view of the newly recited publication by Zhao et al or the newly recited publication by Chen et al.

Sun et al disclose dispersing or dissolving a population of functionalized or non-functionalized single wall nanotubes (SWNTs) in a solvent (dispersing inherently concerning forming of suspension), see paragraphs 49,52 and 63, Paragraph 63 discloses separation of nanotubes of differing sizes and configurations by selectively precipitating the dissolved or solvent dispersed/suspended nanotubes from each other in gel chromatography columns. Selective sorption of types of nanotubes from the fluid mixture or dispersion to the chromatographic media is considered a form of selective precipitation. Paragraph 49 appears to equate "different types and sizes" to semiconducting versus metallic nanotubes. Such chromatographic separation is considered to be a form of selective precipitation in the sense that different populations of nanotubes in a solvent mixture passing through chromatographic columns or media selectively precipitate out of solution to adsorb or absorb to the chromatographic media.

If necessary, Lobovsky et al teach that dispersing of a mixture of nanotubes into solution forms a suspension (column 6, lines 52-56). If necessary, one of ordinary skill in the art would have found it obvious to have considered disclosure of “dispersing” in Sun et al to concern forming of suspension, since this is a known property of nanotube mixtures.

Zhao et al explicitly teaches to separate SWNTs by chirality (metallic from semiconducting), see Abstract, introduction and Conclusion (paragraph bridging pages 11676-11677); as does Chen et al (page 2528, 1st column). If necessary, it would have been obvious to have applied the Sun et al method explicitly to separation of metallic from semiconducting nanotubes, as taught by Zhao et al and/or Chen et al, so as to enhance populations of purified nanotubes with highly specialized properties for industrial applications.

Sun et al further disclose carbon nanotubes for claim 2 (paragraph (p.) 3,4), functionalizing while heating and stirring for claims 3 and 10 (p. 21,35), use of surfactant amines or acids for claims 4,5,9 and 14-18 (p. 22) & also see Chen and Zhao,

Further teachings regarding individual claims are as follows: Zhao teaches reaching of purities exceeding 66%, namely approximating 75% for claims 19-23 (Abstract of Zhao), functionalizing amine being octadecylamine for claim 6 (Zhao at page 11676, 2nd column), use of aromatic and/or aliphatic hydrocarbons for claim 7 (Sun et al at p. 29), use of centrifuging (Zhao at page 11673, 1st column) for claims 8,10,18 and 20, use of various amines for claims 11,13,15 (Sun et al at p. 23-34), use of polar or non-polar solvent for claim 12 (Sun at p. 21), solubilizing agent usage for claim 17 (Sun at p. 30).

Claims 1-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schleier-Smith et al patent 6,669,918 in view of Haddon et al patents 6,187,823 and 6,368,569.

Schleier-Smith et al '918 discloses suspending a population of mixed single wall nanotubes (SWNT) in a suspending solvent of water and/or sulfuric or nitric acid (column 4, lines 28-36 and 54-56 with column 5, lines 43-48) or in a surfactant/solvent mixture (column 5, lines 44-48) , containing mixed *metSWNT* and *semSWNT* nanotubes (column 1, lines 60-65) , followed by separation steps to separate the types of SWNT, including a type of selective precipitation of *met or sem SWNT, concerning employing an initial means for deposition of nanotubes having a selected chirality corresponding to the chirality of either semi-conducting or metallic nanotubes, comprising use of electro-deposition techniques and/or in combination with addition of sorbate material comprising nucleotide bases, followed by later employing of sorption, or 'precipitation' to the surfaces of a template (column 5, line 59-column 6, line 15/ the claims not precluding employ of a first non-template employing precipitation means followed by a later template-employing precipitation means (column 3, lines 24-34 and column 4, lines 62-column 5, line 4)*. The types of SWNTs having different chirality also have different geometry including diameters as discussed at column 3, lines 36-55 and figures 1A, 1B and 2) or different diameter ranges [as in independent claim 19]. The selective separation/deposition/precipitation also concerns selective solvent evaporation (column 5, lines 4-12 and lines 25-33).

Schleier-Smith additionally does not disclose, hence excludes use of templates in the context of seeding in the growth or formation of carbon nanotube fibers, which is the

common, ordinary meaning of "template" in the nanotube or nanotechnology arts, as evidenced by the newly cited Smalley patent .

With regard to claim 14, separation of types of nanotubes, in Schleier-Smith is completed by extraction of the more precipitated type into a solvent (column 5, lines 4-11).

Prior to the separation precipitation and solvent extraction steps, the SWNTs are also functionalized by action of amines or amides (column 5, lines 12-24 in combination with column 6, lines 49-52 indicating that sequences or order of method steps may be reversed or interposed). Hence, such functionalization as disclosed inherently involves "non-acid functionalizing. Haddon '823 clarifies at column 2, lines 9-38 that such functionalizing concerns end groups such as alkylaryl amines, while related Haddon '569 contrasts steps of functionalizing with alkylaryl amines and steps of acid functionalizing with carboxylic and/or mineral acids at column 2, lines 9-40.

It is unclear in Schleier-Smith et al '918 whether such functionalization occurs prior to the suspending step as in claims 1 and 19 or contact with a surfactant amine as in claim 14; thus the claims differ in explicitly requiring that the functionalization precede the separation step. With regard to independent claims 1 and 19, Haddon et al '569 teach functionalizing of SWNTs before shortening (column 1, lines 13-17 and column 2, lines 9-56, etc.). It would have been obvious to one of ordinary skill in the art at the time of the invention, to have proceeded with functionalizing steps to the SWNT's separation by applying of the solvent and selective precipitation, as taught by Haddon '569, since such functionalizing would result in a greater variety of SWNT end products with wider application and to facilitate streamlined manufacture of the SWNT components for specialized predetermined applications.

Claim 14 also differs in requiring the functionalized SWNTs to contact a surfactant amine, as also required or optional in claims 4-8,10-13,20 and 21. However, '918 incorporates functionalization steps of '823 at least before the deposition/precipitation step (see column 5, lines 20-24), with the amines listed in '823 being of the surfactant type (column 6, lines 32-43), (also see column 5, lines 9-23 of '569). It would have also been obvious to have contacted the functionalized SWNTs with surfactant amine, as taught by the Haddon et al patents, to increase their solubility, hence selective separation and also subsequent handling and processing.

The following is further disclosed by Schleier-Smith:

Regarding claim 2, the SWNTs being of carbon is found by '918 beginning at column 1, lines 42-43 of '918. Regarding claims 3 and 20, temperature change assisted separation steps are found at column 5, lines 26-31 of '918 .

Regarding claims 4 and 9, use of acids are found at column lines 31-33, etc. of '918 and in the Detailed Description of the Haddon patents.

With regard to claims 5-8 and 14-18, *and claim 21*, see additionally differ in requiring the surfactant to be an amine. Haddon '823 teaches surfactant-containing solvent, see Haddon et al '823 at column 2, lines 9-49; page 6, lines 25-53; column 8, lines 21-23, etc.

For claims 6 and 11, *as well as claim 21*, specific amines are detailed by Haddon '823 at column 2, lines 21-29 and column 6, lines 32-43.

Claims 7,12,13 and 15-17, *as well as claims 22 and 23*, differ in requiring the solvent employed to be one of various types of polar or non-polar organic solvent. Haddon '823 also teaches a wide variety of solvents, including polar and non-polar types, ethers, aromatic hydrocarbons, alkyl hydrocarbons, etc. (see column 2, lines 38-46 and 54-65 and also column 3, lines 32-38). It would have been further obvious to one of ordinary skill in the art to have utilized the organic solvents taught by Haddon with the Schleier et al '918 process/method, to enable a plurality of chemical reactions to occur at the ends of the SWNT molecules tailored to a variety of specific industrial applications.

Applicant's arguments filed on 9/28/2008, with respect to the rejection of the claims over 35 U.S.C 112, 1st paragraph have been fully considered but they are not persuasive. It is argued.

Applicant's arguments, with respect to rejection of the claims over Holzinger et al have been fully considered and are persuasive. However, new grounds of rejection based on Sun et al and based on Obviousness Type Double Patenting have been advanced, and the Grounds of rejection based on Schleier-Smith are re-introduced in view of re-consideration of the 'template' limitation.

Arguments are directed towards rejection of the claims over 35 U.S.C. 112, 1ST paragraph concerning the negative limitation “excluding adsorption to a template”. Applicants assert that the Specification supports the limitation by reciting numerous examples and embodiments of forms of selective precipitation that do not concern templates. However, the courts have ruled that, **there must be basis in the Specification for adding a negative limitation. There must be express disclaimer or independent lexicography in the written description that would justify adding such negative limitation. Omega Engineering Inc. v. Raytec Corp., 67 USPQ2d 1321. U.S. Court of Appeals Federal Circuit 2003. Nothing in the Specification excludes selective adsorption, absorption or precipitation by means comprising formation of a template to a greater or lesser degree. Also, any negative limitation or exclusionary proviso must have basis in the original disclosure (Ex parte Parks, 20 U.S.P.Q.2d 1234,1236 (Bd. Pat. App & Inter. 1193).**

Additionally, it is submitted that it is unclear as to which of conflicting meanings that the negative limitation concerning templates should be interpreted. It is unclear whether the claims are intended to exclude template in the context of seeding of nanotube fibers as in Smalley, or in the context of selective deposition and sorption, as in Schleier-Smith.

It is argued that Schleier-Smith et al requires use of a template in separating SWNTs, specifically for bulk separation of single-walled nanotubes or fullerenes of a predetermined chirality (semiconducting versus metallic). It is newly submitted that the term 'template' may be fairly considered in the context of "seeding" of nanotube fibrous structures, which concept Schleier-Smith is silent thereto. Hence, Schleier-Smith may be considered as meeting the negative limitation precluding template.

It is also argued that Schleier-Smith discloses "adsorption" of single-walled fullerenes of random chiralities (semiconducting versus metallic) instead of "precipitation". However, the common chemical or chemical engineering meaning of precipitate is of a solid substance that is separated from a solution (hence by any means). Thusly, adsorption/absorption is a subset of precipitation. This same reasoning was applied in the new rejection of the claims over Sun et al.

It is argued that the Haddon patents do not disclose a method of separating types of SWNT's from each other , especially of semiconducting from metallic nanotubes. It is submitted that Haddon was not relied upon for the separation steps claimed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joseph Drodge at telephone number 571-272-1140. The examiner can normally be reached on Monday-Friday from 8:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Roy Sample, can be reached at 571-272-1376. The fax phone number for the examining group where this application is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either private PAIR or Public PAIR, and through Private PAIR only for unpublished applications. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have any questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JWD
January 28, 2009
/Joseph W. Drodge/
Primary Examiner, Art Unit 1797